DOCUMENT RESUME

ED 396 738 IR 017 951

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TITLE An Investigation of the Nature and Form of Interactions in Live Interactive Television.
PUB DATE 96
NOTE 9p.; In: Learning Technologies: Prospects and Pathways. Selected papers from EdTech '96 Biennial Conference of the Australian Society for Educational Technology (Melbourne, Australia, July 7-10, 1996); see IR 017 931.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Access to Education; *Distance Education; Educational Environment; Educational Planning; *Educational Strategies; Educational Technology; Elementary Secondary Education; Foreign Countries; *Interactive Television; Postsecondary Education; Rural Areas; *Teacher Student Relationship; Teaching Methods; *Telecourses; Telephone Instruction
IDENTIFIERS Australia; Learning Environment; Two Way Communication

ABSTRACT

Live interactive television (LIT) is a popular medium for delivering educational programs to students in remote areas in Australia. The medium uses television to deliver a live one-way video signal and standard telephony to provide two-way audio communication between the instructor and students. Much of the potential of this medium is derived from the interactivity between the instructor and students that is supports. Because all interactions are ultimately student-initiated, the medium has a number of unique and characteristic features. This paper describes a study that investigated LIT teaching strategies to determine the ways instructors used the interactive capabilities of the technology in their lesson delivery. The study identified the form, nature, and purpose of interactions employed by instructors and students, the level of student response, and the impact and role of these interactions on lesson development and delivery, through a detailed analysis of transcripts from videotapes of five local LIT teaching programs, including school, vocational, and university-delivered LIT. Transcript analysis revealed that interactions tended to fall into the following types: social, procedural, expository, explanatory, and cognitive. Results of the study found that instructors tend to use the interactive elements more to create a supportive and stimulating learning environment than for instructional support. The most frequently employed forms of instructor-student dialogue were of an informative and discursive nature, with either party providing information in relatively short exchanges. There may be possible shortcomings in current instructional design for LIT, as most instructors make only limited use of the interactive capabilities. There appears to be considerable potential to extend learning outcomes. Future research will investigate strategies for teaching with LIT to increase the level of cognitive interactions while maintaining an environment that is supportive and stimulating for all participants. (Contains 24 references.) (Author/SWC)

An investigation of the nature and form of interactions in Live Interactive Television

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Live Interactive Television is a popular medium for delivering educational programs to students in remote areas in Australia. The medium uses television to deliver a live one-way video signal and standard telephony to provide two-way audio communication between the instructor and students. Much of the potential of this medium is derived from the interactivity between the instructor and students that it supports. Because all interactions are ultimately student-initiated, the medium has a number of unique and characteristic features. This paper describes a study that sought to identify different kinds of interactivity employed by instructors and students and to investigate the impact and role of these interactions on the subsequent instructional activities.

Live interactive television (LIT) is commonly used in Western Australia and other states in Australia, in the delivery of educational programs to school students in remote and rural areas. This technology appears to provide a cost-effective means to deliver educational programs in a variety of formats across vast distances. LIT involves a one-way video link between the teacher and student through conventional television delivery and two-way audio between teacher and students brought about through standard telephone communications.

The popular use of LIT as a delivery medium among local institutions stems from a variety of reasons. It is a relatively inexpensive delivery medium and uses technologies that are widely available among rural areas (Oliver & Grant, 1994). A key component in the choice of this technology is the interactivity that it supports between the instructor and students and the ensuing educational advantages to be derived. This paper describes a study that was undertaken to investigate the form and nature of the interactions that are evident in LIT programs. The purpose of this investigation was to establish the impact of the interactivity provided by the technology in enhancing the quality and form of the instructional programs. The study sought to identify the means by which instructors use the interactive capabilities of the technology and the impact and role of the interactions within the instructional sequences.

Live Interactive Television

Numerous studies have previously reported on the use of LIT in distance and open education programs across a variety of subjects and education levels (eg. Beare, 1989; Dillon, Hengst & Zoller, 1991; Nahl, 1993; Simpson, Pugh & Parchman, 1993; Oliver & Grant, 1995). From these reports, it is evident that many differences exist in the instructional formats being employed and the level of interactivity supported by the technologies has a significant influence on this. Descriptions of research among telecourses with a continuous audio link indicate that audio interactions can be used extensively in delivering and elaborating on lesson content. Kirby and Boak (1989) performed a content analysis of the teacher-student discourse in such a setting. Their results revealed that teachers initiated the vast majority of the interactions and the majority of the discourse was didactic instruction and explanation on the part of the teacher. Questions were used to invoke responses in much the same

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way as teachers use questioning in face-to-face teaching. The questions tended to be narrow and convergent requiring little reflection or consideration on the part of the learners. Furthermore very little communication was observed between students and very little student-initiated discourse occurred. This description of telecourse learning environments is supported by Nahl (1993) and Pugliese (1994) who report a frequent reluctance on the part of many learners to actively use the technology to facilitate interactions between learners and instructors.

A common alternative to a full audioconferencing capability in teleteaching is the use of a telephone communication link initiated by the student. This alternative significantly reduces the cost and equipment infrastructure needed to support the teleteaching program. The system enables students to phone the instructor during a lesson usually on a toll-free number. Instructors provide opportunities for students to make the link during the lesson and when students do so, the teacher-student discourse contributes to the lesson delivery. Many studies report that optimal use is frequently not made of the interactive capabilities of teleteaching technologies. In such settings, students often express dissatisfaction with the lack of direct communication with their instructors (eg. McCleary and Egan, 1989; Pirrong & Lathen, 1990).

Interactivity

The pursuit of interactivity has become a significant goal in the design and provision of distance education and open learning programs. Modern technologies have the potential to overcome the isolation of distance and open learning through the facility of communication lines and learning resources that are responsive to an individual's needs. Innovative applications of such technologies as computer-mediated communications, multimedia and television can now all be used to provide dynamic and customised learning environments. In this context, any learning material or learning environment that provides the learner with more than a passive learning environment is usually said to be *interactive*.

The interactivity that is frequently sought in distance education and open learning is that associated with conversations between the teacher and the student. Whereas conventional interactions between teachers and remote students tend to be asynchronous in nature, classroom conversations tend to be synchronous and in real-time. This is the sort of interactivity afforded by such technologies as teleteaching and LIT. Apart from offering support to teacher-student interactions, these technologies also provide scope to include the two other vital forms of interaction into distance education, learner-learner and learner-content (Moore, 1989; Mason, 1994).

Juler (1990) describes interactivity as a principal aspect of conventional face-to-face teaching that has traditionally been absent from open learning and distance education environments The potential of new technologies to overcome this problem has been met with high levels of enthusiasm by instructional designers and education providers. Interactivity provides a means to motivate and stimulate learners and provides the means for instructors to cause students to consider and reflect on the content and process of learning. Few would dispute the advantages to be derived from the inclusion of interactive elements in teaching and learning and the implicit assumption that interactive environments are superior to others appears to drive much of the activity and development in this field.

Many other technologies, for example, multimedia and computer mediated telecommunications, provide a form of one-to-one communication and conversation between the teacher and student. Previous research has identified the importance of this teacher-student dialogue if the maximum learning potential of the interaction is to be derived (eg. Laurillard, 1993). Many forms of technology used in distance and open education make the provision of one-to-one communication and interaction extremely difficult to achieve as a single teacher often needs to communicate with large numbers of external students. Strategies that have been used to overcome this problem include a range of 'off-air' communication technologies including facsimile machines, e-mail and telephone (Gunawardena, 1990).

Investigating instructional strategies and interactions

Several writers have performed an analysis of the forms of instructional strategies and interactions that are supported by the technologies in LIT and similar settings (eg. Dillon, Hengst & Zoller, 1991).

In an analysis of a series of programs broadcast by the Oklahoma Televised Instruction System, Dillon et al. (1991) found that the majority of instructors favoured a form of teaching which incorporated very little interactivity into the instructional program.

An important question, frequently asked by researchers, is whether the attributes of effective face-to-face teaching are the same as what constitutes effective interactive television teaching? Gehlauf, Shatz & Frye (1991) found that instructors tended to use only a narrow range of instructional strategies and these tended to be based on their conventional teaching practices. There is an acceptance among many researchers that there are new skills that must be developed to effectively teach through interactive television. Chung (1991) provides a detailed description of student perceptions of important attributes of telecourses and a large number of the factors described by the students as essential relate directly to instructional strategies employed by the instructors.

Our previous research has demonstrated that LIT is not necessarily inferior to face-to-face teaching despite the reduced levels of teacher-student discourse that can be achieved (eg. McLoughlin, 1994). In fact minimal amounts of teacher-student interaction are frequently observed in many face-to-face teaching settings. The instructional design processes that accompany conventional teaching planning appear to make little use of interactions with individual students as a means to develop lesson content. Despite the many different forms and functions for interactions to take, many teacher-student interactions occur for reasons other than providing individualised feedback to aid individual learners (Cazden, 1988).

Research Aims

The purpose of this study was to investigate LIT teaching strategies with the view to determining the ways instructors used the interactive capabilities of the technology in their lesson delivery. Initially we were interested in examining the ways in which different instructors employed interactions in order to establish patterns of use and to quantify instructors' preferred forms of interactivity. Also of interest was the impact of the interactions created by the instructors on the learning environment. The study sought to determine:

- the form, nature and purpose of the interactions in each instructional setting,
- the level of student response, and
- the impact of different interactive activities on lesson development and delivery,

through a detailed analysis of a range of local LIT teaching episodes and programs.

Methodology

The investigation of interactions in LIT teaching and learning was carried out by analysis of teacher-student discourse across a range of LIT courses and programs. Videotapes were obtained of 5 LIT courses representative of programming in Western Australia. The courses included school, vocational and university delivered programs. Five consecutive lessons from each of the courses were observed and transcriptions made of the teaching-learning interactions. A content analysis was conducted across each of the programs to provide information to determine the nature and forms of interactions used in the instructional process.

Framework for analysis of interactions

This investigation was the study of the discourse of interaction and communication between participants was object of focal attention, consistent with the conversational framework of Laurillard (1993). Consideration was given to procedures of classroom observation which have been the subject of debate and research (Flanders, 1970; Cazden, 1988). Interaction analysis describes and categorises various aspects of instructional practices that take place between teachers and students in contexts where there is a teaching-learning transaction. Such analyses are typically guided by an observation instrument consisting of a list of predetermined relevant categories of behaviours that observers look for and record. One criticism made of such schemes is that they consist of a set of predetermined categories that seriously limits and restricts the observers perceptions. In other words, using such a observation scheme would produce tunnel vision, because the observer would tend to see only behaviours that coincided with the observation scheme.

Type of Interaction	Description	Example
social	teacher/student talk establishing and developing rapport	T: Hello Mandy, how are you? S: Very well thank you. T: Great to hear from you, what are you going to do for us?
procedural	teacher/student dialogue involving information exchange on course requirements and procedures	S: Mr Gray, can you tell me how many pages you want us to write? T: I'm looking for about 2 pages in total. S: Can we use a topic of our own choice?
expository	student or teacher demonstrating knowledge or skill in response to a direct request from another.	T: Can any one tell me the correct name for this animal? S: Is it raptorus maximus? T: No, but it is from the raptorus family.
explanatory	teacher using student responses to explain knowledge and develop content.	T: This is how we place our fingers to play the note A. Can you play an A for me Mandy? S: Mandy plays an A. T: That was good but you have to blow a bit harder and make sure your fingers are covering the holes completely.
cognitive	teacher providing constructive feedback to a student response causing the student to reflect and to consider an alternative perspective/reality.	T: Can you tell me what you think was the main reason for his actions? S: He was angry and wanted to get even. T: But was that all? What about his wish to improve his position and standing? S: I suppose but he did but I though that he would done it differently.

Table 1. A Framework for investigating interactions in Live Interactive Television

A more recent scheme developed by Henri (1992), based on the findings of cognitive psychology, aims to delve deeper into the different levels of meaning in messages in order to study the complexity of the learning process. Content analysis, as this approach is known, is an analytical approach which highlights the critical dimensions of the learning process: participative , interactive , social, cognitive and metacognitive. Content analysis was chosen for the present study because of its potential to provide a multilevel understanding of the learning process. As the original framework was developed by Henri (1992) for computer mediated communication, a modified version of the approach was used to create a framework for our investigation of LIT interactions. The need for students to initiate interactions in LIT has the potential to influences significantly the type and form of interactions which occur. An initial analysis of the videotaped lessons led to the identification of 5 types of communicative interactions evident in LIT teaching environments. Table 1 describes each of these interactions and provides an example and description of each.

Data Gathering

The videotape transcriptions for each of the courses were analysed using the above framework with each teacher-student communication being considered and classified. Other details of each interaction were also noted including the number of exchanges involved and duration of the exchanges. Most interactions were clearly of one form and were classified with little difficulty. Some interactions, however, were of a form that combined elements from two dimensions. For example, several exchanges involved a social and explanatory form of communication. In such cases, it was possible to describe and classify two interactions in the one communication episode.

Results

The following section describes the teaching programs that were investigated and the forms of the interaction that were evident in the 5 courses that were reviewed.

Program 1. Playing the Recorder This series of lessons involved a teacher using the television to teach remote students to play the recorder. The course was televised in a narrowcast format to primary school children in rural areas studying by correspondence. Students were invited to participate in the course which acted as an enrichment adjunct to the conventional program. Students electing to join in the course were supplied with course notes and music samples and given a program of instruction and activity to follow. The television programs acted as support for the overall course. Each lesson involved the teacher demonstrating the fingering and actions associated with playing notes on the recorder and playing small tunes. Students were invited to call through to play their own tunes to show their skills and to demonstrate their progress.

All interactions in this series of lessons involved a social dimension as well as some other purpose. The teacher took the time to chat with each student who called, many of whom were known previously to him. The majority of the interactions also served an expository purpose with a child playing a piece on the recorder. In almost all instances, the feedback was positive and general. There was minimal use made of the students' playing to provide feedback that caused reflection or that caused some change in performance or activity. There were a number of instances when the feedback was used to make a general and explanatory point to all students. There were no procedural interactions. The television instruction was designed to supplement a correspondence course framework . Procedural matters were dealt with through independent interactions between the students and their course tutors.

Program 2. Science Matters Science Matters was a weekly television program broadcast by a local university to a public viewing audience with the intention of providing a series of interesting science topics for general viewing with the support of a talkback feature to extend the likely learning outcomes able to be achieved. A range of topics was chosen for the course. Each program was anchored by a science teacher and involved a studio interview/discussion with a relevant expert with viewers encouraged to call and to ask questions or to answer questions posed by the presenters.

This series of programs proved to be quite interactive. Each program typically received 6 to 8 calls from viewers. There were few social interactions among these. This was brought about by the open nature of the course delivery and the change in expert from program to program. There were only two social interactions observed and these occurred when viewers identified themselves as having called previously and greeted the presenter in a manner that led to a social exchange. The explanatory interactions in the program were brought about through the presenter and expert discussing aspects of the topic. The presenter frequently asked questions and sought clarification in much the same way as face-to-face students do in normal classrooms. At the same time, the expert often spoke to the presenter and sought feedback as an instructional strategy.

Program 3. Computer Applications Computer Applications was a series of programs involving instruction and demonstration in the use of a personal computer and applications software. The instruction was well suited to television broadcast with screen displays and instructions and outcomes clearly presented on the TV monitor. The series of programs was aimed at providing elementary computer instruction for general viewing and sought to take computer novices with computer hardware and software along the track to computer self-sufficiency. An interactive element was built into the course to enable viewers to call in if there were queries and questions that arose from the instruction being given.

Viewers were frequently reminded of the talkback facility and encouraged to call in with questions. The presenter tended to follow a planned course of instruction and provided little opportunity for student participation other than direct questions. Whereas in other settings, the presenters planned and sought interactions through direct questions, offering incentives and appropriate presentation of content, this course offered a general invitation to callers but did not have an established place for interactions in the lesson design. As a consequence, few interactions resulted and those that did were mainly of an expository nature, being direct questions from students requiring specific answers.

Program 4. Women in Australian Society This course was a 12 week series of lessons narrowcast to an enrolled viewing audience in local access points in towns in rural Western Australia. Students enrolled in this course and received course materials and information supplemented by the interactive television broadcast. The course was designed as a short course for rural students and delivered through a vocational education program. The presenter was aware of the enrolled students and received assignments and work samples from them throughout the course.

The nature of the lessons from week to week was a discussion of relevant topics inviting responses from the viewers mingled with feedback on materials and work submitted by the students as part of the course requirements. The interactive component within this series of lessons formed a significant part of the teaching and learning. The instructor relied heavily on discussing issues and problems with the students as a means of presenting the course content and causing students to reflect and consider. The lessons were planned with interactions as a critical teaching element. This was a course in which cognitive interactions were evident. The presenter used the cognitive interactions to draw information from students and to cause them to consider responses and to reflect on their own impressions and attitudes.

Program 5. Childcare The Childcare course was a 15 week course delivered through correspondence mode to rural students as part of an award course. The television component was a supplement to the correspondence mode and was received by the rural students at local access points. The interactive element provided a means for student-teacher communication and was planned into each lesson by the instructor.

The form of dialogue that was encouraged saw many of the interactions being of an explanatory form where the teacher encouraged other students to help present course content. These forms of interactions tended to involve many short exchanges between the student and instructor. In this way a considerable part of the teaching in any session was actually as a result of student explanation with the instructor guiding. At times, these explanations became cognitive interactions as the instructor probed and questioned students to further understanding.

This set of lessons revealed a large number of procedural interactions. Students frequently asked questions relating to course requirements when they called. These interactions tended to be handled quickly by the instructor who then took the opportunity to establish a dialogue with the student resulting in forms of exchanges representing other forms of interactivity. Frequently a procedural interaction with a student was followed immediately by an explanatory or expository interaction.

Table 2 shows a comparison of the relative frequency of the different forms of interaction observed across the 5 teaching programs.

Discussion

Interesting patterns were revealed in the analysis of the different forms of interaction used in teaching episodes across the 5 courses using. The most common form of interaction used in these settings was expository and involved answers to direct question, either teacher or student initiated. Other common interactions that were observed were social and explanatory. Both of these were seen to serve useful purposes and were used frequently by the teachers. In one setting, there was a high proportion of procedural interactivity while most other courses demonstrated very little of this. It was interesting but not unexpected to find that low levels of cognitive interactivity were prevalent in most teaching settings. This is interesting because one of the main reasons given to support the need for teacher-student interactivity in distance learning is based on the contention that interactions are able to enhance cognition and higher order learning. In LIT, the use of interactions for this purpose is not strongly evident.

The nature of the course and the viewing audience appeared to have a large impact on the forms of interactivity evident in the teaching episodes. In courses where there were enrolled students, for example Childcare and Women in Australian Society, the instructors tended to use the interactions as teaching instruments. Explanatory and cognitive interactions were quite prevalent. In situations where the audience was open and the instruction less focused on a course, for example Computer Applications and Science Matters, the interactions were expository in the main and less linked to a planned instructional program.

	social	procedural	expository	explanatory	cognitive
Playing the Recorder	56%	0%	38%	6%	0%
Science Matters	4%	0%	70%	26%	0%
Computer Applications	0%	10%	71%	19%	0%
Women in Australian Society	32%	0%	0%	29%	39%
Childcare	15%	39%	3%	33%	10%
Average	21%	10%	36%	23%	10%

Table 2. Relative frequency of observed interactions across 5 programs

Students were observed to play a major role in the interactive episodes in all the lessons that were observed. In the first instance, the students initiated the interaction and did so with some specific intent. This tends to be quite different from normal teacher-student interactions where the teacher is usually the initiator of the interaction. When the teacher initiates the dialogue, the student usually responds directly to either a question or an imperative. In LIT settings, it is the teacher who initially becomes the respondent. It is only after the student's request has been answered that the teacher can perhaps initiate some further dialogue or communication. In this study, it was clear that many instructors chose not to further the communication after the initial dialogue. This resulted in a large number of exchanges being observed that tended to be short in duration and involving low levels of cognitive activity on the part of teacher and student. It was evident however that cognitive interactions are possible and relatively easy to implement through appropriate instructor-led communication and dialogue.

Summary and Conclusions

Live Interactive Television is a popular medium among many rural students as an adjunct and support for open learning courses and programs. Despite limitations in the interactivity it can support, it appears that the interactions that are achieved in instructional applications can serve very useful purposes. Our study has found that instructors tend to use the interactive elements, more to create a supportive and stimulating learning environment than for instructional support. Observations of the forms of instructor-student dialogue revealed that the most frequently employed were those of an informative and discursive nature where either party gave information to the other in relatively short exchanges.

It would appear that instructors may be under-utilising the potential of LIT as a medium capable of supporting cognitive interactions. Most instructors appear to use the interactive capability in a secondary capacity in their teaching and learning. Using the interactions for other than short exchanges in LIT has its inherent difficulties. As stated earlier, the instructor must wait for the student to call before any form of dialogue is possible. Once a call has been received, the instructor has to take control of the communication in order to initiate interactions of a higher cognitive order than might normally occur. This requires a degree of skill and experience on the part of the instructor and would appear to be a skill that might take some time to develop. At the same time, the instructor needs to be able to incorporate interactive elements into the planned instructional program. In this regard, LIT appears to require particular instructional design considerations that could be explicitly stated as a guide for intending instructors.

It is likely that LIT will continue to be used in the local context as a delivery medium for a range of open learning programs. The outcomes from this research have demonstrated possible shortcomings in current instructional design for this medium. Most instructors appear to make only limited use of the interactive capabilities and there appears to be considerable potential to extend learning outcomes. In our future research we plan to investigate strategies that can be employed in teaching with LIT to increase the level of cognitive interactions while maintaining an environment that is supportive and stimulating for all participants.

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